



United States Department of Agriculture

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# Photo-Guide for Frozen Corn on the Cob

Illustrating Defects and  
Development PG-14

Marketing and Regulatory Programs  
Agricultural Marketing Service  
Fruit and Vegetable Program  
Specialty Crops Inspection Division  
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## PREFACE

These instructions are designed primarily for Specialty Crops Inspection Division Fruit and Vegetable inspectors of the United States Department of Agriculture, Agricultural Marketing Service. They are not intended to be a comprehensive treatise on the subject, but to give background information and guidelines to assist in the uniform application and interpretation of USDA grade standards and other similar specifications.

These instructions incorporate USDA photographs and guidance which were originally distributed to field offices in June 1974 and were expanded with input and cooperation from the frozen corn-on-the-cob processing industry. These instructions are revised as necessary without public notice and no mailing list is maintained as a public advisory of such changes. This photo-guide supersedes the use of all previous editions of photographic instructions for inspection of frozen corn on the cob.

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Information contained in this instruction is available to the public. Questions about the information in this guide should be addressed to:

Director, Specialty Crops Inspection Division  
Fruit and Vegetable Program, AMS  
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Washington, DC 20250-0240

This photo-guide is designed to be used in conjunction with the U. S. Standards for Grades of Frozen Corn on the Cob. The images in this book provide guidance in evaluating defects and development.

The section on Defects provides images which depict blemished kernels, crushed or broken kernels, freezer burn and dehydration, husk, stalk, poorly trimmed units, missing kernels as a result of processing, and, pathological damage.

The section on "Development" provides images which depict development defects, row separation, nonparallel rows, underdeveloped, and missing and undeveloped kernels.

# DEFECTS

## General

This factor refers to the degree of freedom from such defects such as crushed and broken kernels, blemished kernels, poorly trimmed ears, attached stalk, husk, and dark or readily noticeable silk.

Crushed and broken kernels, blemished kernels, poorly trimmed ears, and attached stalk are scored on the basis of individual ears, regardless of length.

Husk and silk are aggregated and scored on the basis of a sample unit.

## Conditions of Evaluation

The classification of defects is done after the product has been water-thawed.

For natural style, defects over the outermost one (1) inch of the tip end of the ear are not scored, except for those kernels which are classified as blemished.



**Blemished kernels (includes, but is not limited to, kernels affected by discoloration, blemishes, pathological injury, or other damage):**

**Short Length Ears.**

To classify as a minor defect, 1 or 2 kernels are affected.

The following 2 images depict minor defects.



To classify as a major defect, 3 or 4 kernels are affected.

To classify as a severe defect, more than 4 kernels are affected.

The following image depicts a severe defect.



**Regular Length Ears.**

To classify as a minor defect, 2 or 3 kernels are affected.

To classify as a major defect, 4, 5, or 6 kernels are affected. This is an example of pathological damage.

The following image depicts a major defect



To classify as a severe defect, more than 6 kernels are affected.

The following image depicts a severe defect.



**Crushed or broken kernels (other than those at end of ears caused by trimming or cutting):**

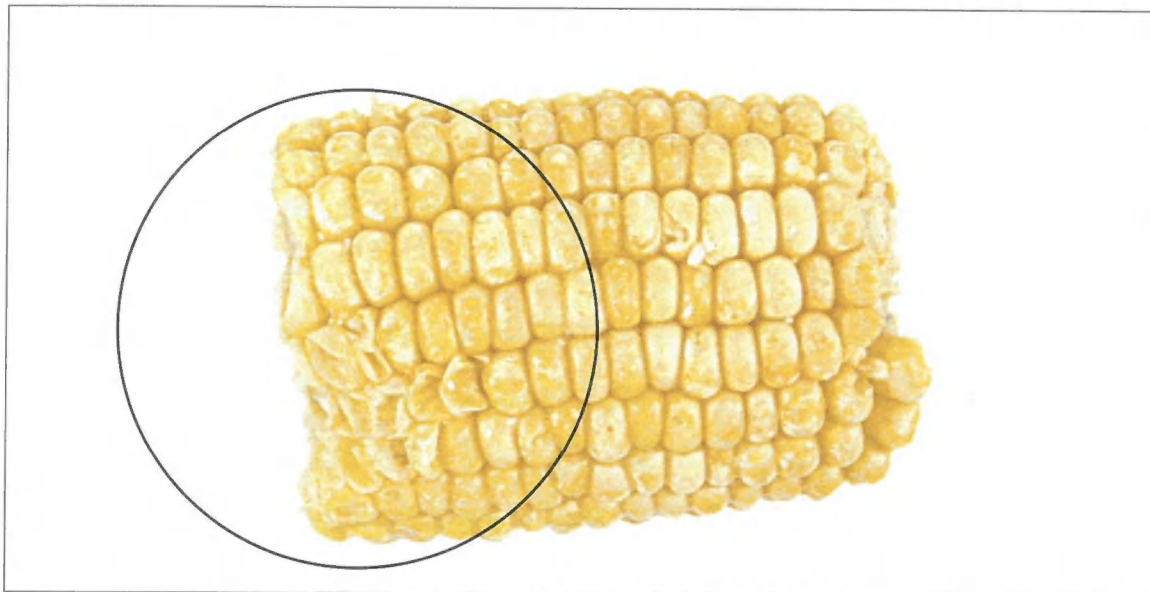
**Short Length Ears.**

To classify as a minor defect, 7 to 15 kernels are affected.

The following image depicts the upper limit for non-scoreable.

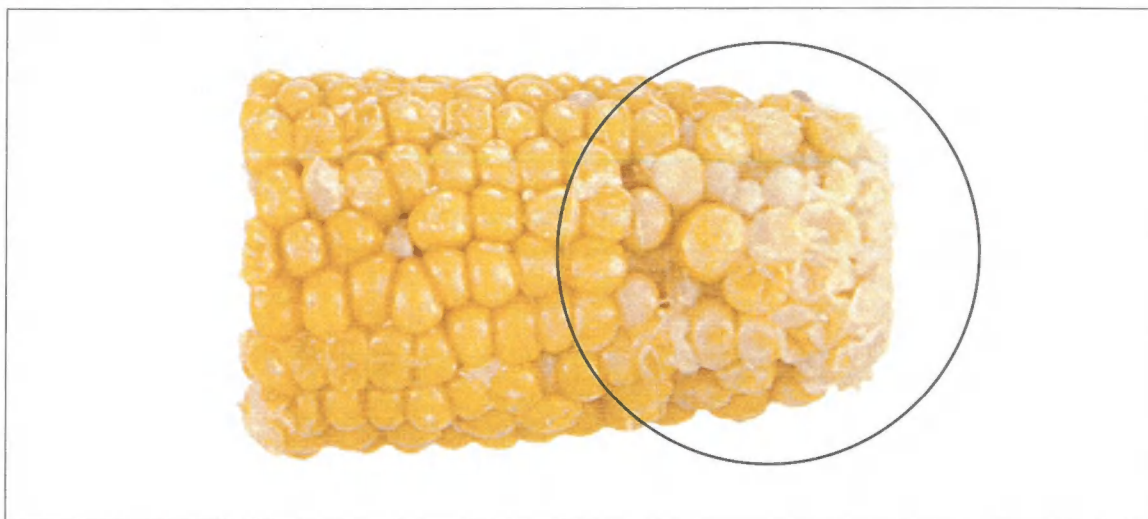


The following image depicts the lower limit to classify as a minor defect.





The following image depicts a minor defect.



The following image depicts the upper limit to classify as a minor defect.



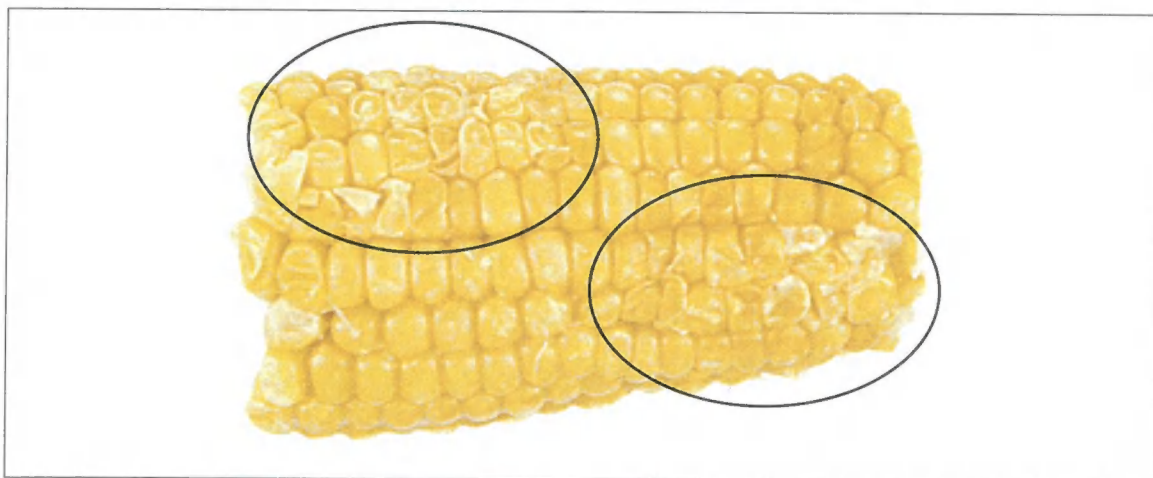
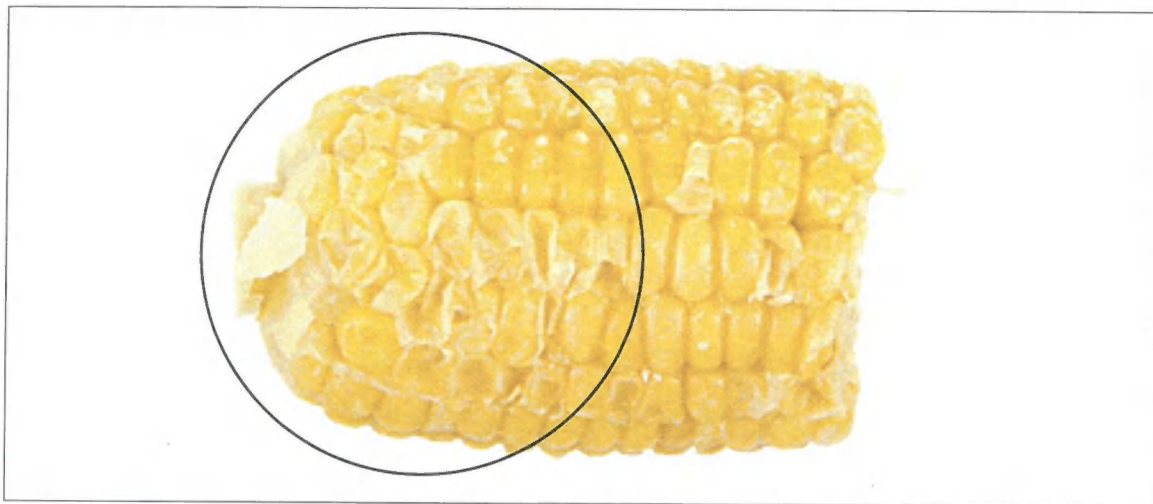


To classify as a major defect, 16 to 30 kernels are affected.

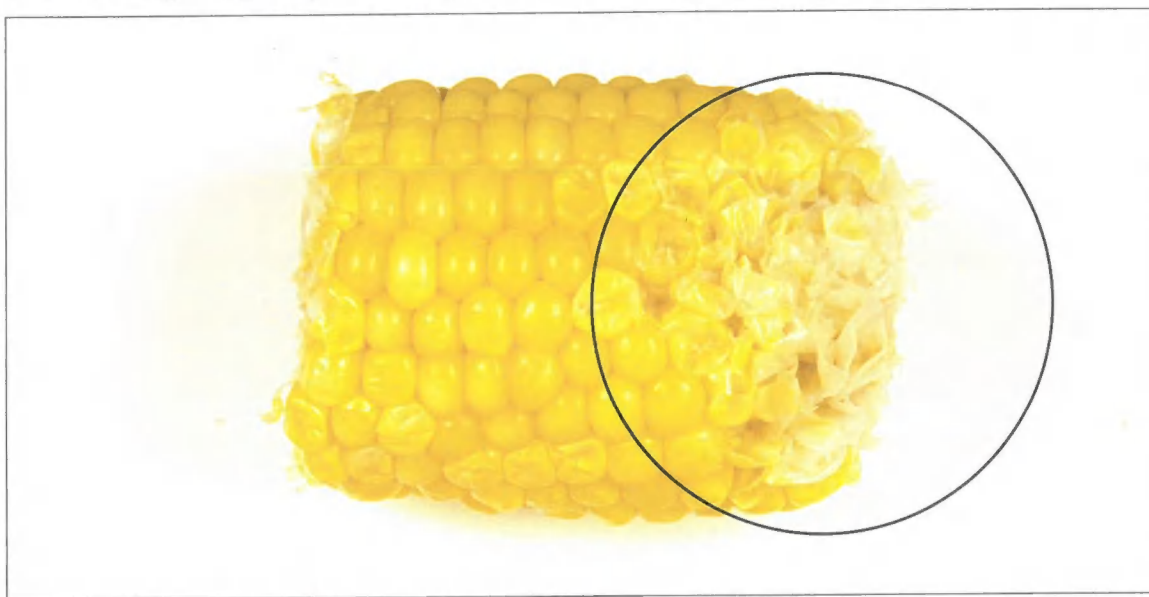
The following image depicts the lower limit to classify as a major defect.



The following 2 images depict major defects.



The following image depicts the upper limit to classify as a major defect.



The following image depicts a severe defect.



**Regular Length Ears.**

The following 2 images depict non-scoreable defects.





To classify as a minor defect, 10 to 25 kernels are affected.

The following image depicts the lower limit for a minor defect.



The following 2 images depict minor defects.



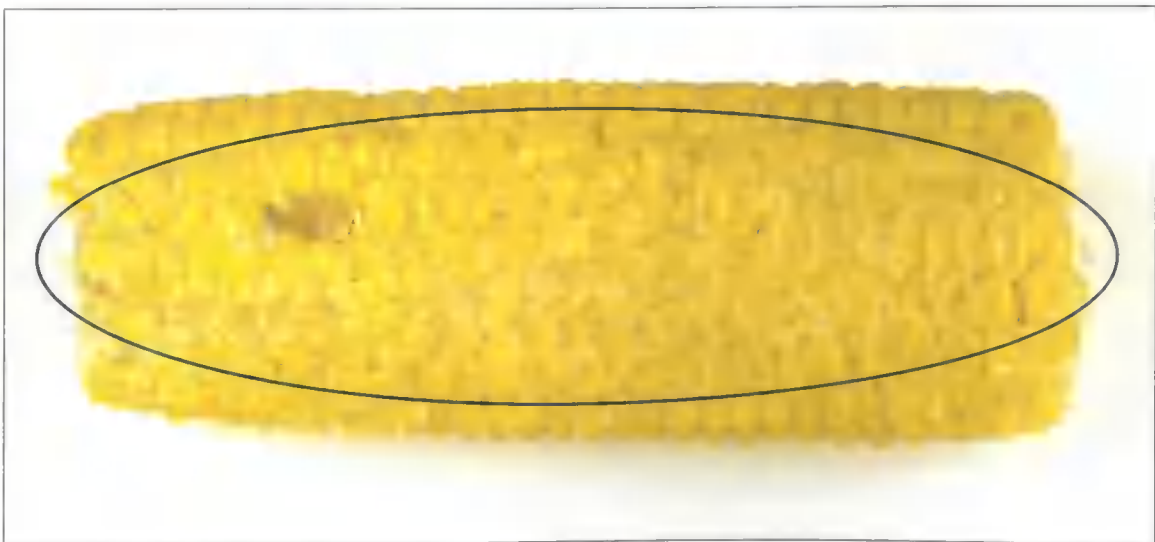
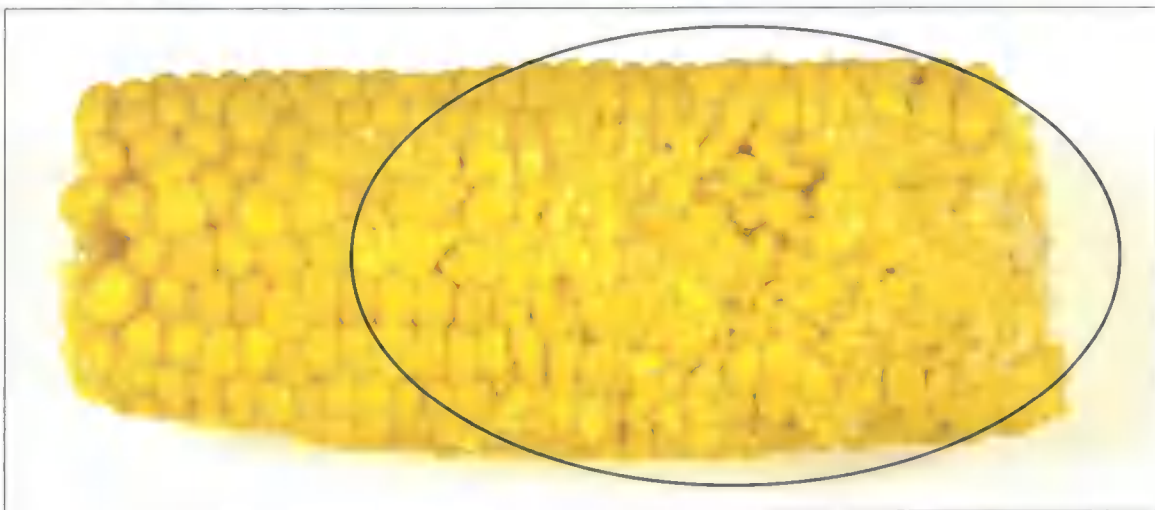
The following image depicts the upper limit to score as a minor defect.



To classify as a major defect, 26 to 50 kernels are affected.

To classify as a severe defect, more than 50 kernels are affected.

The following 2 images depict severe defects.



**Poorly trimmed ears:**

The following image depicts a non-scoreable trim defect.



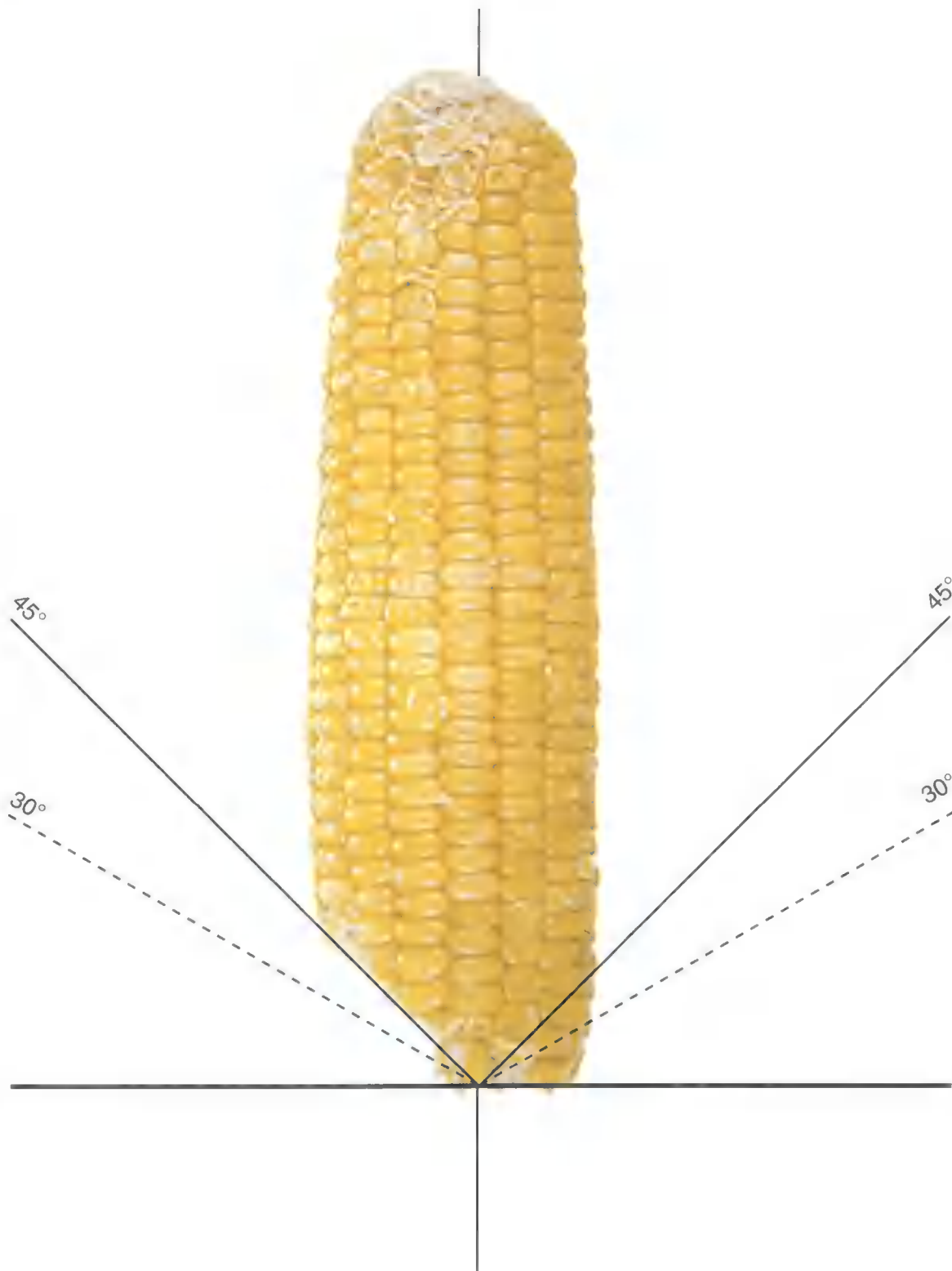
More than 30°, but not more than 45°, from a right angle cut is classified as a minor defect.

The following image depicts a minor defect.

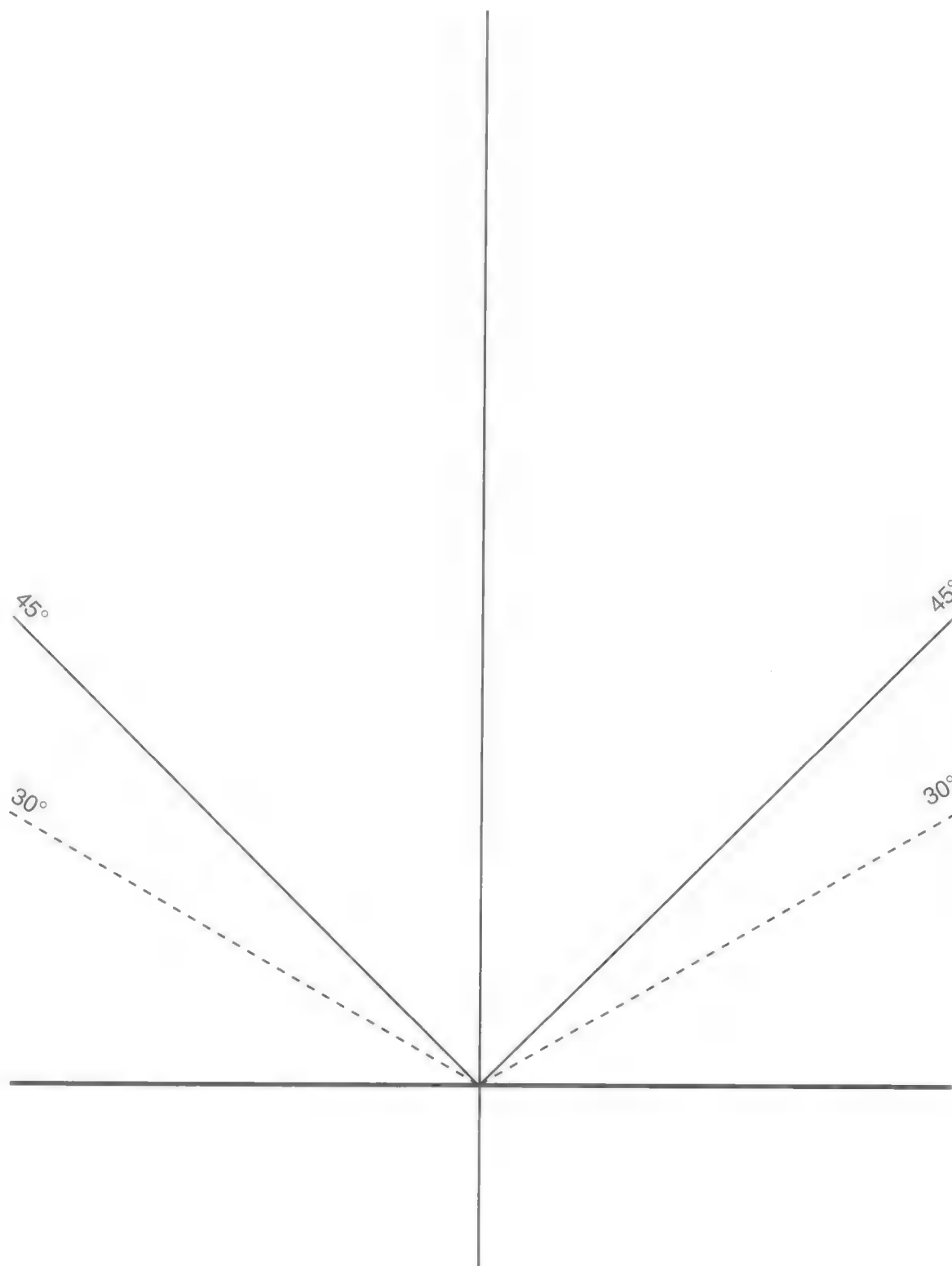




More than  $45^\circ$  from a right angle cut is classified as a major defect.  
The following image depicts a minor defect.



Template for use when determining poorly trimmed ears.



**Stalk:**

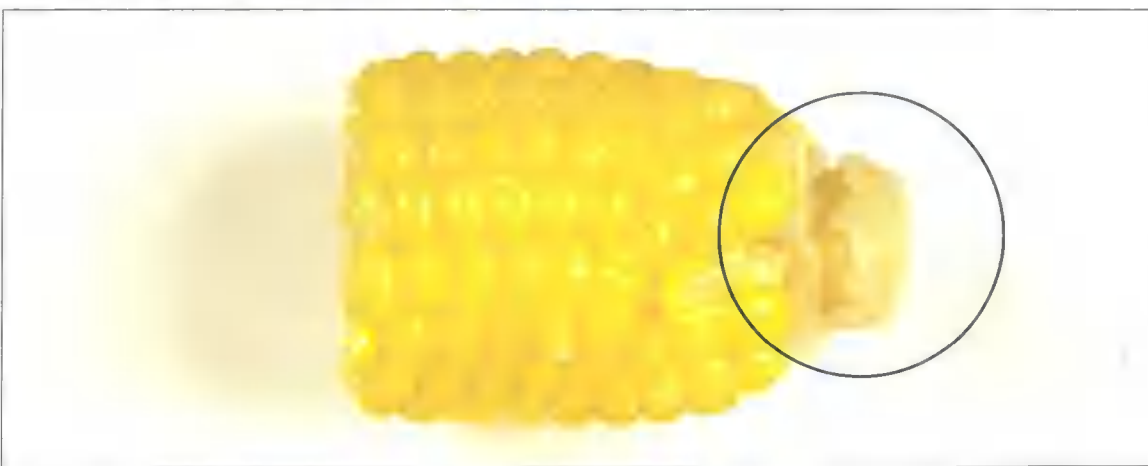
If less than  $\frac{1}{4}$  inch of stalk is present, classify as insignificant and do not score.

The following image depicts the upper limit to classify as non-scoreable



More than  $\frac{1}{4}$  inch, but not more than  $\frac{1}{2}$  inch, of attached stalk is classified as minor defect.

The following image depicts a minor defect.

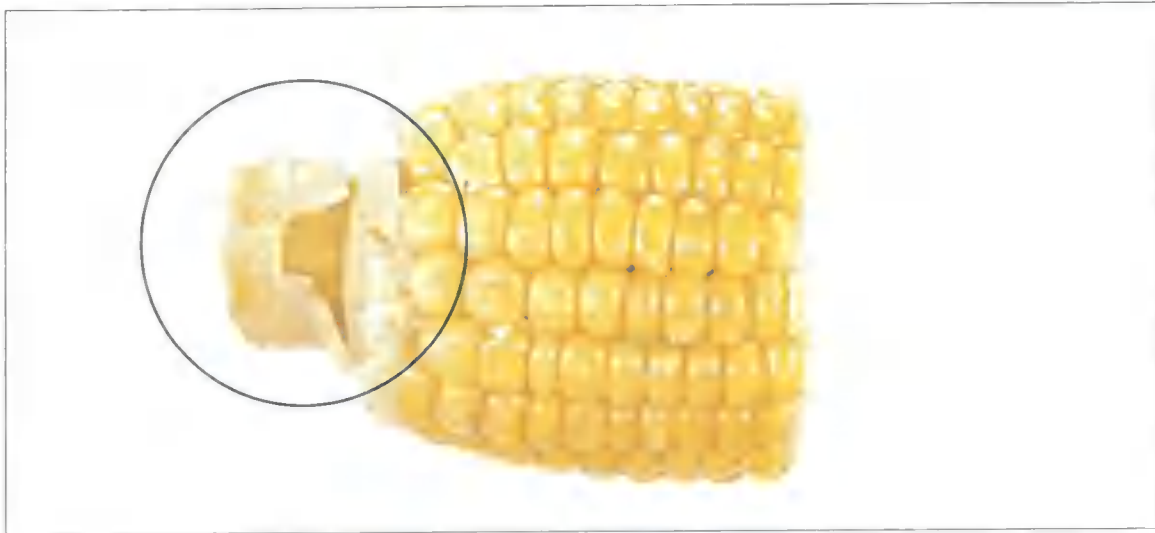


The following image depicts the upper limit to classify as a minor defect.





More than ½ inch of attached stalk is classified as a major defect.  
The following 2 images depict major defects.



The following defects are aggregated and apply to the entire sample unit.

**Attached or loose husk:**

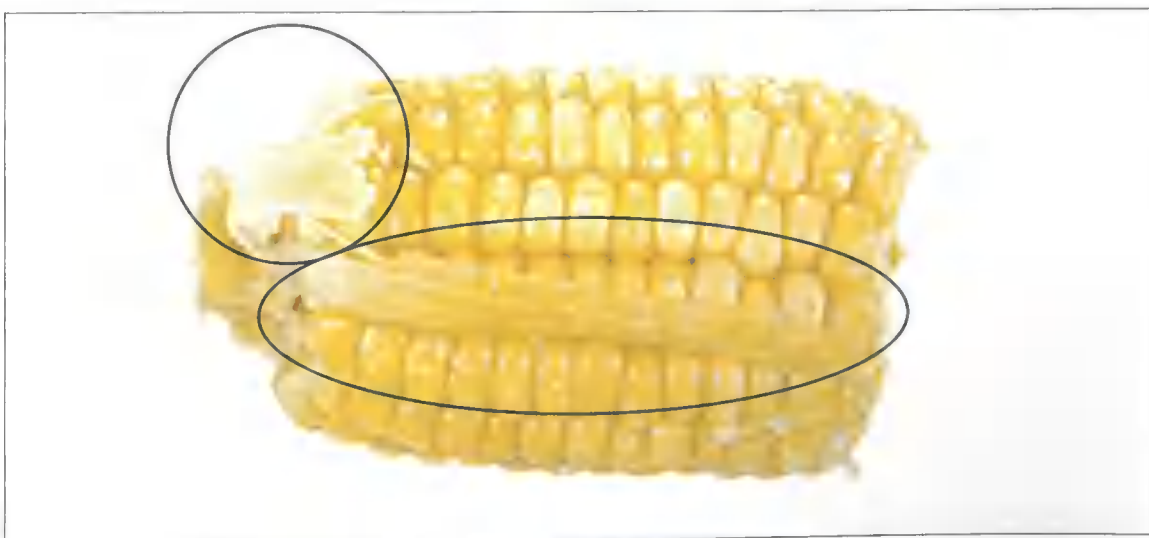
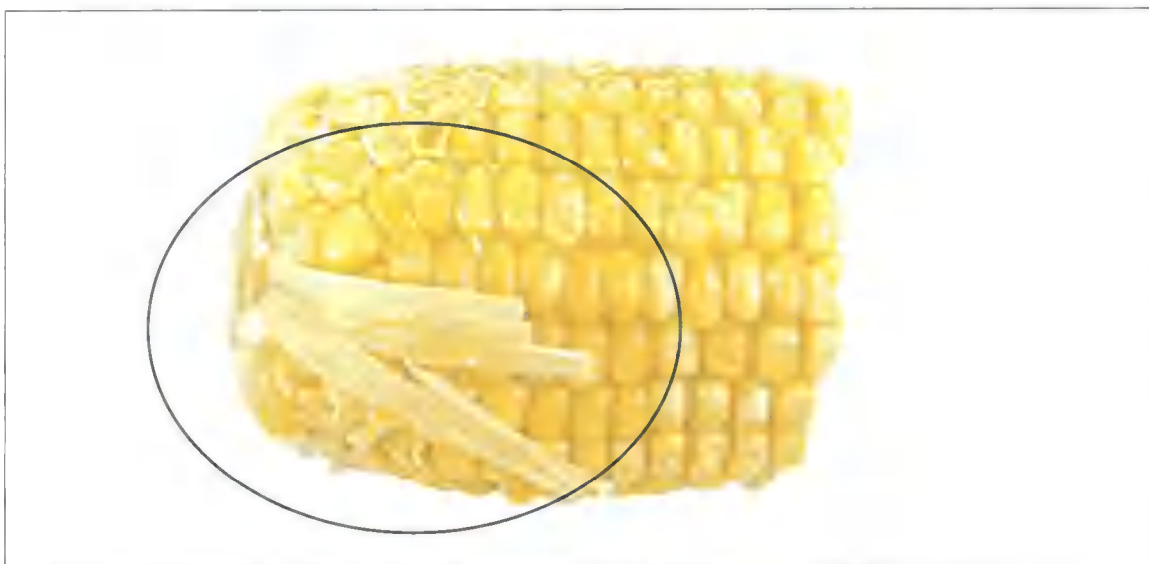
Husk and silk are aggregated and scored on the basis of a sample unit. Measure the total amount in the sample (4 regular ears or 8 short length ears) and score as follows:

More than one (1) square inch but not more than two (2) square inches is classified as a minor defect.

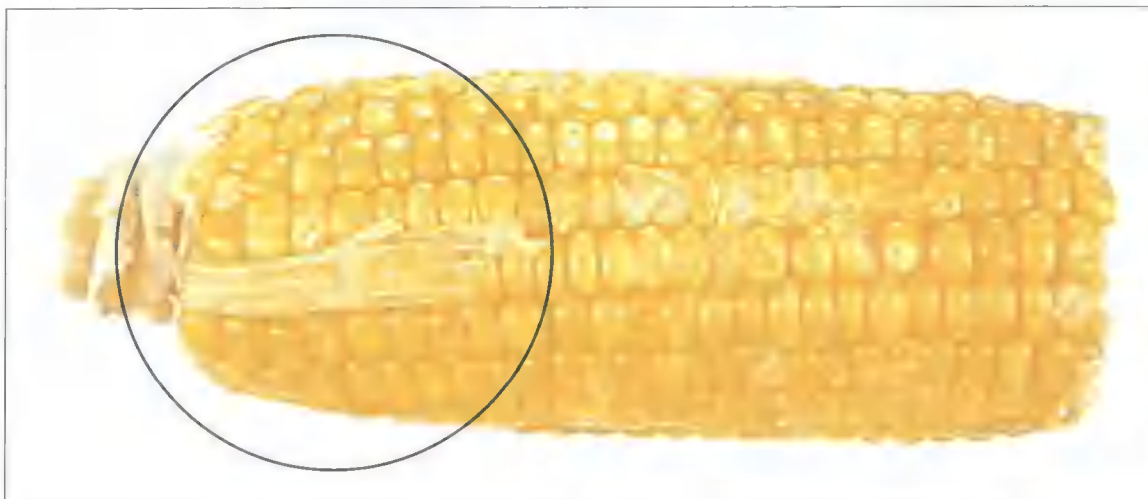
More than two (2) square inches but not more than three (3) square inches is classified as a major defect.

More than three (3) square inches is classified as a severe defect.

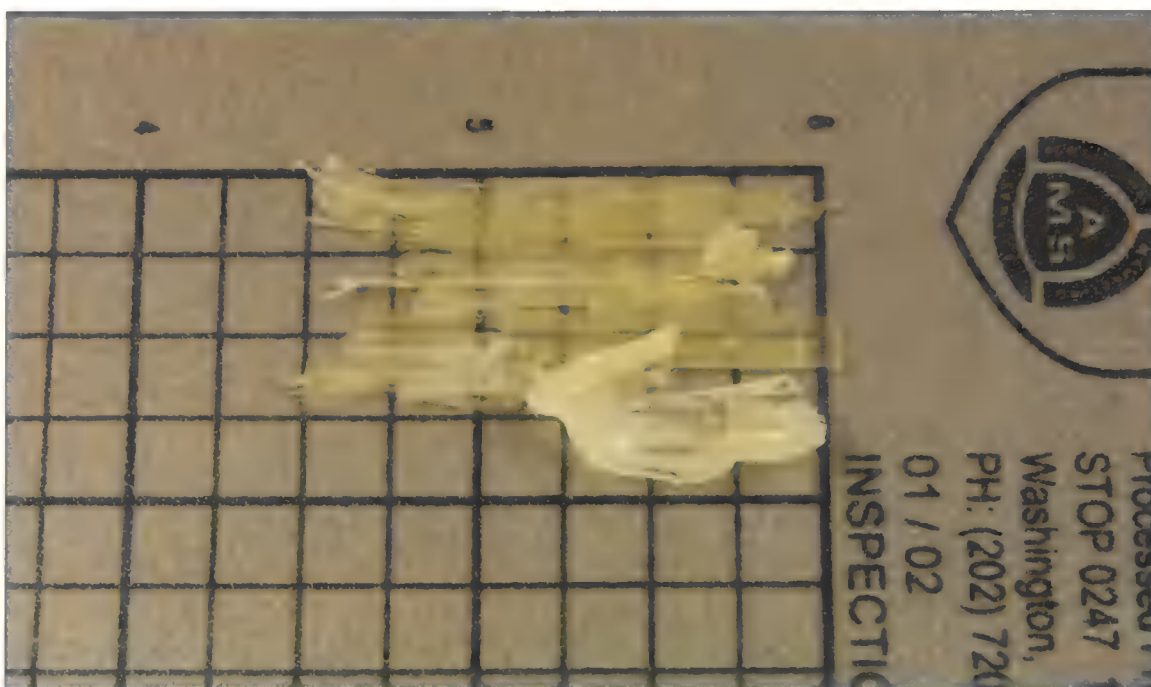
The following 2 images depict attached husk.



The following image depicts attached husk.



The following image depicts husk being measured.





**Dark or readily noticeable silk (strands one (1) inch or longer):**

Husk and silk are aggregated and scored on the basis of a sample unit. Measure the total amount in the sample (4 regular ears or 8 short length ears) and score as follows:

Ten to 20 inches are classified as a minor defect.

Twenty-one to 30 inches are classified as a major defect.

Over 30 inches are classified as a severe defect.

**Defects****Freezer Burn or Dehydration****Freezer burn or dehydration:**

No specific tolerances have been established for this defect by the grade standards. It is scored under the general allowances for each grade level as follows:

**“A” classification. Practically free from defects** means that:

- (1) Any combination of defects present (whether or not specifically defined) may slightly, but not materially, detract from the appearance or edibility of the product;

**“B” classification. Reasonably free from defects** means that:

- (1) Any combination of defects present (whether or not specifically defined) does not seriously detract from the appearance or edibility of the product;

The following image depicts non-scoreable damage.



The following 2 images depict units that are materially affected by Freezer Burn or Dehydration and are scoreable against Grade A.



**Missing Kernels:**

No specific tolerances have been established for this defect by the grade standards. It is scored under the general allowances for each grade level as follows:

"A" classification. Practically free from defects means that:

(1) Any combination of defects present (whether or not specifically defined) may slightly, but not materially, detract from the appearance or edibility of the product;

"B" classification. Reasonably free from defects means that:

(1) Any combination of defects present (whether or not specifically defined) does not seriously detract from the appearance or edibility of the product; A-Memo 466 was issued in October 1978 to provide additional guidance for scoring missing kernels.

**These images depict kernels which are missing due to mechanical injury or other means. The cob is clearly visible where the kernels have fallen out or have been removed during processing or freezing. Neighboring kernels have a normal appearance.** The following tolerances apply to classification of the defect missing kernels. These tolerances apply to each individual ear.

One (1) missing kernel is not scoreable.

Two (2) to five (5) missing kernels are classified as a minor defect. (Materially affected)

The following image depicts a minor defect.



Six (6) to ten (10) missing kernels are classified as a major defect. (Seriously affected)  
The following image depicts a major defect.



Eleven (11) or more missing kernels are classified as a severe defect.  
The following image depicts a severe defect.



After totaling the defects for each sample, apply the tolerances in Table IV, found in the U.S. Standards for Grades of Frozen Corn on the Cob, to determine the grade.



# DEVELOPMENT

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## General

This factor refers to the extent that the ears are filled with corn kernels and the pattern arrangement, as applicable, of such kernels on the cob.

Classification of "development defects," if applicable, is made on each ear regardless of length.

Evaluation of this factor is made on the basis of a sample unit.

## Conditions of Evaluation

The classification of "development defects" is done after the product has been water-thawed to the extent that the outer surfaces are substantially free from ice crystals.

For natural style, "development defects" over the outermost one (1) inch of the tip end of the ear are not scored, except for those kernels which are classified as blemished.

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## Development

## Twisted Ear

### Twisted Ear:

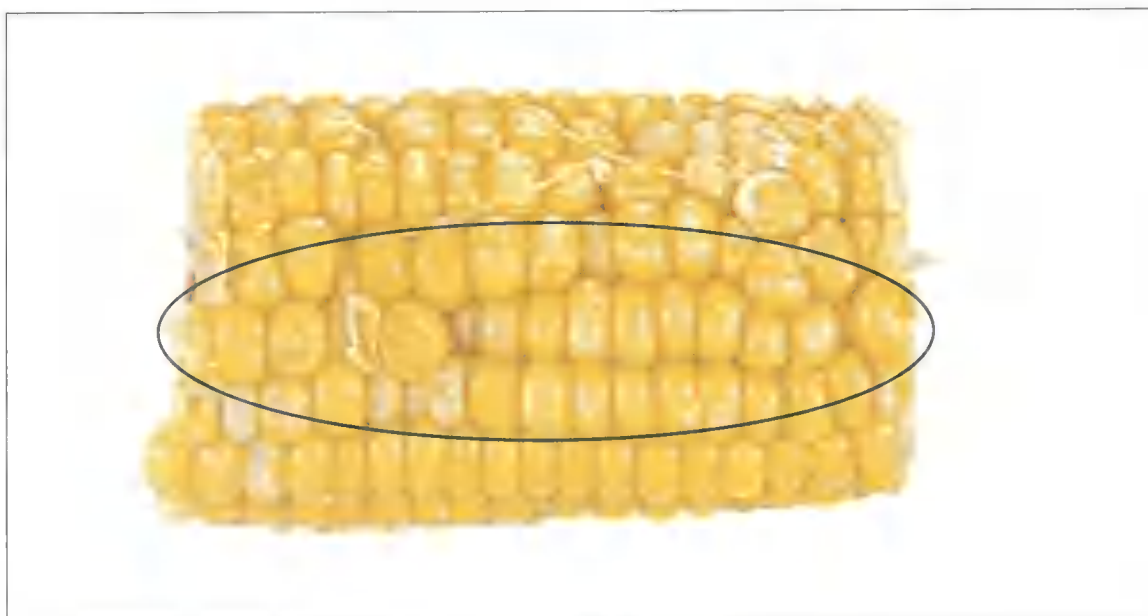
An ear twisted – more than the width of 4 rows of kernels or more than  $\frac{1}{4}$  of the circumference—from one end to the other is classified as a minor defect.

**Nonparallel rows of kernels:**

Not applicable to varieties which characteristically have staggered rows.

An ear having an area comprised of three (3) or more adjacent nonparallel rows extending more than two (2) inches, lengthwise, of the ear is classified as a minor defect.

The following 2 images depict non-scoreable damage.



The following image depicts non-scoreable damage.



The following image depicts the lower limit to score as a minor defect.



The following 3 images depict minor defect.





Aggregate the damage and classify as a minor defect.  
The following image depicts a minor defect.



**Separation of rows extending  $\frac{1}{2}$  the length of the ear:**

One space showing cob more than  $\frac{1}{4}$ , but not more than  $\frac{1}{2}$  the width of an average size kernel is classified as a minor defect.

The following image depicts a minor defect.



Two or more such spaces showing cob more than  $\frac{1}{4}$ , but not more than  $\frac{1}{2}$ , the width of an average size kernel are classified as a major defect.

A space or spaces showing cob more than  $\frac{1}{2}$  the width of an average size kernel is classified as a major defect.

**Underdeveloped and Undeveloped Kernels:**

These images depict kernels which did not grow or mature properly. Neighboring kernels may be irregular in appearance because as they grow, they try to fill the additional space.

Specific tolerances have not been established for the grade standards for undeveloped and underdeveloped kernels. Defects are classified based on whether the appearance of the sample unit is "Materially Affected" or "Seriously Affected" by the undeveloped or underdeveloped kernels.

The following 3 images depict non-scoreable damage for underdeveloped kernels.



The following image depicts the uppermost limit for non-scoreable for underdeveloped kernels.



The following image depicts developmental defects in the outermost (last) inch of natural style ears and is not scoreable.





The following 3 images depict units that are materially affected.



The following image depicts the lower limit to classify as seriously affected



The following image depicts a seriously affected unit.



The following 2 images depict seriously affected units.



After totaling the defects for each sample, apply the tolerances in Table III, found in the U.S. Standards for Grades of Frozen Corn on the Cob, to determine the grade.



## SCORING COBS WITH MULTIPLE DEFECTS

Cobs with multiple defects should be evaluated by identifying all defects present and classifying the severity of each defect.

The following image depicts a cob that is affected by multiple defects; not all defects are classified as scoreable.



This cob is affected by:

Defects:

Missing Kernels: Severe defect (more than 11 kernels are missing)

Dehydration: Materially affected

Crushed kernels: Not scoreable (less than 10 kernels are affected).

## Scoring Cobs with Multiple Defects

The following image depicts a unit that is affected by multiple defects; not all of the defects are classified as scoreable.



This cob is affected by:

Defects:

Trim: Not scoreable (less than 30° angle).

Development Defects:

Nonparallel rows: Minor (three or more adjacent rows are affected, less than 2 inches in length).

Undeveloped kernels: Seriously affected

The following image depicts a unit that is affected by multiple defects; not all of the defects are classified as scoreable.



This cob is affected by:

Defects:

Crushed Kernels: Not scoreable

Husk: Remove, measure, and apply tolerances under (f) Definitions and classifications of defects.

Development defects:

Separation of rows: Minor.





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